REMARKS

Rejection under 35 USC 103(a) in view of Gass et al., Onishi et al., and O'Neill et al.

Claims 1-7, 12-15, 17-24, and 27-30 are rejected as allegedly being obvious in view of Gass et al. (US 5,808,716), Onishi et al. (US 5,814,378) and O'Neill et al. (US 2003/00219113). This rejection is respectfully traversed.

In the rejection, it is asserted that Gass et al. disclose an alignment layer, wherein after preparation thereof, the alignment layer contains at least one reactive additive such as an acrylate compound. Applicants disagree. The alignment layers of Gass et al. do not after preparation contain a reactive additive, let alone a reactive mesogenic additive.

As described in the abstract, Gass et al. disclose a liquid crystal display having a cell formed from glass walls which is filled with a layer of liquid crystal material, and in which the glass cell walls have alignment layers. In order to increase resistance to mechanical damage, the liquid crystal layer is bonded to the alignment layers.

As shown in Figures 4 and 5, Gass et al. disclose two embodiments of their invention. In the embodiment shown in Figs. 4a and 4b, alignment layers 3 and 4 are applied to each of the glass layers. Smectic liquid crystal molecules adjacent each alignment layer are chemically bonded to the alignment layers. See, e.g., column 4, lines 23-34. In the embodiment of Fig. 5, smectic alignment layers 5 and 6 are fixed to the alignment layers 3 and 4 that are attached to the two glass walls. Gass et al. describe several ways of making these two embodiments.

The first technique Gass et al. describe for making the embodiment of Fig. 4a is described at column 4, lines 48-61. In this technique, the alignment layers on the inner surfaces of the glass plates contain reactive groups, e.g., acrylates. Once the required smectic layer structure is achieved in the liquid crystal layer, chemical bonding is induced between these acrylate reactive groups of the alignment layers and the FLC (ferroelectric liquid crystal) molecules. As a result, layers of FLC molecules are permanently bonded to the alignment layers 3 and 4 as shown in Fig. 4a.

In this technique, the alignment layers do not contain reactive compounds or reactive additives, but instead the alignment materials contain reactive groups. Furthermore, Gass et

al. do not disclose that the alignment layer, after its preparation, contains least one reactive mesogen additive with unreacted polymerizable groups.

The second technique Gass et al. describe for making the embodiment of Fig. 4a is set forth at column 4, line 62 – column 5, line 18. In this technique, the alignment layers on the inner surfaces of the glass plates are coated with conventional alignment layers. Then the cell is filled with FLC material which contains reactive mesogens, e.g., mesogenic molecules with acrylate groups. When the required smectic layer structure is achieved, chemical bonding between the reactive mesogens and the alignment layer is induced.

Thus, according to this technique, the alignment layers do not contain either reactive compounds/additives or reactive groups. The reactive mesogens are present in the liquid crystal layer, not the alignment layers. Furthermore, Gass et al. do not disclose that the alignment layer, after its preparation, contains least one reactive mesogen additive with unreacted polymerizable groups.

The third and final technique for making the embodiment of Fig. 4a is described by Gass et al. at column 5, line 19 – column 6, line 15. In this technique, the alignment layers on the inner surfaces of the glass plates are coated with alignment layers that contain reactive groups. In addition, the FLC material contains reactive mesogens. The reactive groups in the FLC material and the reactive groups in the alignment layers are selective in that bonding occurs primarily between reactive groups in the FLC material and reactive groups in the alignment layers, but not between groups in the FLC material or between groups in the alignment layers. After the cell is filed with the FLC material which contains reactive mesogens and once the required smectic layer structure is achieved, chemical bonding is induced between the reactive groups in the alignment layers and the reactive groups in the FLC material.

In the text bridging columns 5/6 and 7/8, Gass et al. describe two polymerization reactions using UV radiation for use in the above-mentioned third technique. In the first reaction, a liquid crystal compound containing a ketone is reacted with an olefin group in the alignment layer. In the second reaction, a liquid crystal compound containing a pyrrole group is reacted with an olefin group in the alignment layer.

Thus, as with the first technique, the alignment layers do not contain reactive compounds or reactive additives, but instead they contain reactive groups. Furthermore, Gass

et al. do not disclose that the alignment layer, after its preparation, contains least one reactive mesogen additive with unreacted polymerizable groups.

Gass et al. describe two techniques for making the embodiment of Fig. 5. See column 7, line 51-column 8, line 29. In each of these techniques, the alignment layers 3 and 4 are formed conventionally. As with the second technique describe above, these alignment layers do not contain either reactive compounds/additives or reactive groups.

Therefore, contrary to the assertion in the rejection, Gass et al. do not disclose an alignment layer, wherein after preparation thereof, the alignment layer contains at least one reactive additive such as an acrylate compound, let alone an alignment layer that contains least one reactive mesogen additive with unreacted polymerizable groups.

Additionally, contrary to the assertion in the rejection, Gass et al. do not disclose the addition of a reactive mesogen acrylate additive to the alignment layer. The reactive mesogen referred to by Gass et al. is contained in the FLC material, not in the alignment layer. Also contrary to the assertion in the rejection, Gass et al. do not disclose a polymer precursor for making an alignment layer.

In the rejection, it is acknowledged that Gass et al. fail to disclose that the reactive acrylate groups in the alignment layer are reactive groups on mesogenic compounds. In this regard, the rejection relies on the disclosure of Onishi et al. Specifically, it is argued that Onishi et al. disclose that by using reactive mesogens in the alignment layer better alignment control is provided over the liquid crystal molecules, citing column 7, lines 10-25.

Onishi et al. disclose a liquid crystal display having a pair of substrates (at least one of which is transparent), and, positioned between the substrates, a liquid crystal layer having a liquid crystal region surrounded by a polymer region. The polymer region of the liquid crystal layer is formed from a monomer having at least containing the polymerizable compound represented by Formula (I) of Onishi et al. This polymerizable compound of Onishi et al. has an ethylene-type unsaturated group and a fluorinated alkyl group, which are both bonded to a mesogen backbone having liquid crystal properties. See column 6, lines 62-65.

At column 7, lines 10-25, Onishi et al. disclose that if one were to use a liquid crystal material and a separate polymerizable compound, a polymer region between the alignment and a liquid crystal region would be formed from the polymerizable compound. Onishi et al.

disclose that this would reduce orientation restriction force of the alignment film for the liquid crystal molecules. Conversely, when the polymerizable compound has a mesogen backbone (as in the case of the polymerizable compound represented by Formula (I) of Onishi et al.) the polymer region has a polymer which has a structure similar to that of liquid crystal molecules, and thus the polymer region "becomes capable of transmitting the orientation restricting force of the alignment film."

As can be seen from the above description, the polymerizable compound utilized by Onishi et al. is part of the liquid crystal layer, **not part of the alignment layer.** As stated by Onishi et al., the polymer region is part of the liquid crystal layer and this polymer region is formed from the polymerizable compound of Formula I. In addition, as with the disclosure of Gass et al., Onishi et al. do not disclose an alignment layer, wherein after preparation thereof, the alignment layer contains at least one reactive additive such as an acrylate compound, let alone an alignment layer that contains least one reactive mesogen additive with unreacted polymerizable groups.

In the rejection, it is argued that O'Neill et al. disclose an alignment layer comprising a reactive mesogen in accordance with applicants formula II (see claim 12), namely compound 4 disclosed at paragraph [0025].

O'Neill et al. discloses a liquid crystal alignment layer containing a transport material that is chemically bound to the alignment layer. As described in paragraph [0005], a transport material in the alignment layer will produce enhanced electrical conductivity thereof. But, when the alignment layer is used in a liquid crystal cell, the transport material tends to migrate into the liquid crystal. To address this problem, O'Neill et al. chemically bind the transport material to the alignment layer.

As discussed in paragraphs [0024]-[0026], the alignment layer which can comprise a side chain liquid crystal polymer, or can comprise a reactive liquid crystal formed from a reactive mesogen. The alignment layer comprising a reactive liquid crystal formed from a reactive mesogen is produced by coating the reactive liquid crystal material onto a substrate, and then drying and curing the material while in the liquid crystal phase to form an anisotropic polymer film. As stated by O'Neill et al. "In these cases the liquid crystal polymer or reactive mesogen is coated onto a conventional alignment layer."

Thus, this embodiment is similar to the embodiment of Fig. 5 of Gass et al. in that it

has an alignment layer and an adjacent polymerized layer formed from a reactive mesogen. In this embodiment, O'Neill et al. do not disclose or suggest an alignment layer that comprises a polymer film containing at least one reactive mesogen additive. Nor does O'Neill et al. describe an alignment layer, comprising a polymer film containing at least one reactive mesogen additive, wherein the additive has unreacted polymerizable groups after preparation of the alignment layer.

In the rejection, it is asserted that it would be obvious to use O'Neill et al.'s reactive mesogen acrylate identified as compound 4 as the reactive acrylate compound in the alignment layer of Gass et al. However, neither Gass et al. nor O'Neill et al. actually describe an alignment layer in which the alignment layer itself contains at least one reactive mesogen. As shown in Figure 5 of Gass et al. and as described in paragraph [0026] of O'Neill et al. the reactive mesogen is used to form an additional layer on the conventional alignment layer.

Furthermore, neither O'Neill et al. nor Gass et al. describe an alignment layer comprising a polymer film containing at least one reactive mesogen additive, wherein the additive has unreacted polymerizable groups after preparation of the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al. (US '716), alone or in combination the disclosures of Onishi et al. (US '378) and/or O'Neill et al. (US '113), fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

<u>Rejection under 35 USC 103(a) in view of Gass et al., Onishi et al., O'Neill et al., and Ichimura et al.</u>

Claims 8-11, 25, and 26 are rejected as allegedly being obvious by Gass et al. (US 5,808,716) in view of Onishi et al. (US 5,814,378), O'Neill et al. (US 2003/00219113) Ichimura et al. (US 6,001,277). This rejection is respectfully traversed.

In the rejection, it is acknowledged that Gass et al., Onishi et al., and O'Neill et al. do not describe an alignment layer comprising a polymer film and a reactive mesogenic acrylate additive wherein the polymer film is a polyimide film, a triacetate cellulose film, or a diacetate cellulose film. However, as discussed above, none of these references describe or suggest any alignment layer comprising a polymer film and a reactive mesogenic additive.

Ichimura et al. disclose a liquid-crystal display device that comprises a pair of

substrates, each of which is provided with a liquid-crystal alignment film, at least one the substrates having an electrode, and a liquid crystal held between the substrates. The liquid-crystal alignment films comprise a resin that contains photoisomerizable and dichroic structural units, such as units of azobenzene derivatives and stilbene derivatives. See column 4, lines 7-47. As described at column 9, lines 31-44, the photoisomerizable and dichroic structural units may be mixed with the resin and can be chemically bonded to each other or to the resin by at least one of light irradiation and heating.

Ichimura et al. does not, however, disclose or suggest an alignment layer that comprises a polymer film containing at least one reactive mesogen additive, wherein the additive has unreacted polymerizable groups after preparation of the alignment layer.

In the rejection, it is asserted that Ichimura et al. disclose polyimide and acetate cellulose films and that it would be obvious to use such films in the system of Gass et al.

However, as noted above, the disclosure of Ichimura et al., as with the disclosures of Gass et al., Onishi et al., and O'Neill et al., does not disclose or suggest an alignment layer that comprises a polymer film containing at least one reactive mesogen additive, wherein the additive has unreacted polymerizable groups after preparation of the alignment layer.

In view of the above remarks, it is respectfully submitted that the disclosure of Gass et al. (US '716), alone or in combination the disclosures of Onishi et al. (US '378), O'Neill et al. (US '113), and/or Ichimura et al., fails to render obvious applicants' claimed invention. Withdrawal of the rejection is respectfully requested.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

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